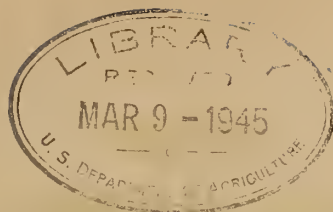


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PRESERVATION OF VEGETABLES BY SALTING AND BRINING

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SPECIAL INFORMATION ON COMMERCIAL APPLICATION

Instructions given in this mimeograph are intended particularly for the homemaker. They may be adapted for larger scale, commercial use, however, by increasing the general proportions.

Studies made to date indicate that the following suggestions as to commercial procedure should receive particular attention:

Treatment: The preservation treatment selected will largely depend on the vegetables to be preserved and their intended uses. Probably the dry-salting method in which a large amount of salt is used (see page 6) will be of most general value to the commercial packer.

Blanching: Attention is called to the importance of blanching most vegetables prior to salting or brining. This is preferably done in flowing steam.

Containers: For convenience in handling and maintaining the brined material in storage, the use of headed kegs or barrels is suggested. When methods permitting gaseous fermentation are used, a small hole must be left open in the head until the fermentation has taken place. Before the containers are finally bunged, they should be filled with brine of the same concentration as that used in the preserving method followed. By using tight containers and keeping them completely filled with brine, scum growth and accompanying problems will be avoided.

Storage: The use of refrigerated storage (at 35° F.) is recommended where facilities are available. Vegetables preserved with a small amount of salt (see page 4) or with a low salt brine (see page 7) will undergo fermentation even in refrigerated storage, although this action may be somewhat slower than at ordinary storage temperatures. Vegetables preserved with at least 15 percent salt and promptly placed at refrigerated temperature will undergo little or no active fermentation for a storage period of about 6 months or more.

INTRODUCTION

Many people are familiar with the production of sauerkraut from cabbage and the production of salt-stock and dill pickles from cucumbers. In these cases, salt is used as the principal agent in bringing about preservation. Preservation by the use of salt can be applied to other vegetables as well and should be especially useful when the usual methods of preservation, such as canning and freezing, cannot be employed due to lack of facilities, labor, or essential materials. It is a simple and inexpensive emergency method which may be used to prevent the waste of certain vegetables. Due to the nature of preservation by salt, the final product does not necessarily compare in general quality with that of similar canned products.

Methods of Salt Preservation

(Dry Salting)

There are but two basic methods of preservation depending upon the use of salt. In the dry salting method, dry salt is added directly to the vegetable material as it is packed. This brings water out of the vegetable material, dissolving the salt and thereby forming brine. If a small amount of salt is used, an active acid fermentation takes place. This process is brought about by microscopic plants called bacteria--in this case, beneficial bacteria--which use the sugars from the vegetables as food and produce acid. These tiny organisms are similar to those responsible for the souring of milk. Dry salting, using a small amount of salt ($2\frac{1}{2}$ to 5 percent by weight), is usually employed for vegetables that are readily cut or shredded and that are high in water content, yet contain enough sugar to develop a vigorous acid fermentation. A preserving effect is obtained by the combined action of salt and the acid produced by the fermentation. Cabbage and lettuce are typical examples of materials that are salted in this manner. Blanched snap beans is another. Products preserved by this treatment have a tart flavor which is relished by many.

If a large amount of dry salt is used, little or no acid is produced since the acid-forming bacteria are unable to grow to any extent under this condition. Certain vegetables are best preserved when a large amount of salt (20 percent by weight) is used. Corn, lima beans, and green peas are examples of vegetables considered to be in this group. When a large amount of salt is used, the preserving effect is due principally to the action of salt alone.

(Brining)

The other basic method of preservation by the use of salt is called brining. In this case the salt (brine) solution is poured on the vegetables. Water is thereby withdrawn and the brine becomes diluted. When weak brines--those containing a small amount of salt--are used, an active acid fermentation takes place similar to that described for dry salting. If strong

brines--those containing a large amount of salt--are used, little or no acid is produced. In general, brining is used for bulky or whole vegetables and those that may be low in water content. Also, brining may be used to advantage where the effect of shrinkage on the shape and structure of the vegetable material, caused by the use of dry salt, would be unduly severe. For some vegetables, a weak brine plus a small amount of vinegar is used. The addition of vinegar to the brine insures a desirable fermentation and aids in avoiding possible spoilage.

Precautions

The detailed directions which follow are for two methods of dry salting and two of brining. Each method is best adapted for use with particular vegetables. Study the methods and directions carefully and pick out the method best suited for the vegetable or vegetables that are to be preserved.

The directions must be faithfully carried out if a satisfactory product is to be obtained. The vegetables must be carefully weighed and the salt must be weighed or measured according to directions. Pure, granulated salt should be used. It should not be coarse, nor should it contain any of the ingredients commonly used in table salt to prevent caking. The grades of salt suggested for use are: Granulated or Evaporated Flake.

In the dry-salting procedure, the salt must be distributed uniformly throughout the entire mass of vegetable. Do not use too much at first.

It is important that the vegetable material be covered with brine at all times to prevent spoilage of the surface layer. In straight-sided containers such as crocks, weighting the cover that is placed on top of the salted material causes the brine to rise over the salted vegetables. In jars or other containers with small necks in which weights cannot be conveniently applied the material must be held beneath the brine under slight compression by means of inserted crosspieces. If the brine does not cover the vegetable after the jars have been firmly packed and the crosspieces inserted, sufficient brine of the proper strength must be added.

Keep the brine surface free from insects and heavy scum growth.

Vegetables brined in large containers should be repacked shortly after active fermentation has ceased in order to eliminate the need for frequent attention. Smaller containers can be sealed and stored for several months.

Peas, beans, corn, and greens preserved by brining should be boiled 10 minutes before being tasted or eaten. Discard material that is soft or has an objectionable odor. (These recommendations, always made for home-canned products, apply to salt-preserved products also.)

Brine-or salt-preserved vegetables, such as snap beans, may require considerably more cooking than the fresh vegetables. This is particularly true for those that are not blanched (scalded) prior to salting or brining. Otherwise they may be used in practically the same way as fresh vegetables.

Equipment and Supplies Needed

For containers use sound, clean jars, crocks, kegs, or barrels. If possible wooden containers should be paraffined inside. Do not use containers made of yellow or pitch pine.

As previously indicated, some provisions must be made for covering the packed vegetable material and keeping it beneath the brine surface. A weighted, loose-fitting, latticed wooden cover is satisfactory for straight-sided containers such as crocks. Plates, crock tops, or circular pieces of boards slightly smaller in diameter than the crocks are also satisfactory. Paraffined bricks or heavy stones (other than limestone) make suitable weights. In jars, the vegetables can be held under the brine by means of wooden cross-pieces. Wooden strips slightly longer than the width of the jar mouth are slipped endwise into the jar and the ends engaged under the jar neck so that the packed vegetable is held below the brine surface under slight compression.

Other necessary items: Kitchen scales; measuring cup; pint, quart, and gallon jars; clean white cheesecloth; sharp knives; cabbage cutter; pure salt of the grades listed.

DRY SALTING

Using a Small Amount of Salt

Dry salt preservation of vegetables by use of a small amount of salt (2-1/2 to 5 percent by weight) is practiced extensively by commercial concerns and in the home for the production of sauerkraut from cabbage. This process results in the production of acid and gives a distinctive tart flavor to the final product.

Vegetables

Cabbage	Rutabagas
Lettuce	Snap beans
Turnips	

Preparation of Vegetables

Select fresh, sound material.

Trim off outside leaves of cabbage and lettuce heads, remove cores and quarter.

Wash root vegetables and trim off tops.

Blanch (scald) snap beans about 5 minutes in boiling water or steamer and cool promptly. Ship the beans and cut into short lengths.

Salting Procedure

1. Cabbage, lettuce, turnips, and rutabagas: Shred with a sharp knife or cutter and pack into sound, clean jars, crocks, kegs, or barrels, allowing one-fourth pound (4-oz.) of salt for each 10 pounds of vegetable. Distribute the salt evenly. Small quantities of the vegetables may be salted in glass jars of 1-gallon capacity or smaller fitted with screw-type lids. When using these small containers it will be necessary to mix the measured quantities of vegetable and salt in a large pan before packing tightly into the jars (see Table 2, Treatment 1, page 13, for proportions of salt).
2. For snap beans, distribute evenly one-half pound of salt (8-oz.) with each 10 pounds of material packed. Add 8-oz. of household vinegar for each 10 pounds of snap beans.
3. After the salt-vegetable mixture has been packed into the container, place several layers of clean, white cheesecloth on top of the material and tuck down the sides. On the cloth place a cover that fits loosely inside the container. A plate, crock top, or circular wooden top will do. Weight the cover well so the brine that is formed will reach the cover within 24 hours.
4. Store the containers in a cool place (70 to 75° F.). An acid fermentation starts shortly after the material is salted and will continue for 2 or 3 weeks.

Removal of Scum

A white surface scum will appear on the brine surface within a few days. Keep this scum removed. If allowed to grow unrestricted, it will not only use up the acid produced from the fermentation, but will give off a bad odor and may result in an inferior fermented product.

Scum and insects may be easily removed by the following procedure: Remove the weight and cover, being careful to avoid mixing the scum with the brine. Lift the cloth carefully so that the surface material (scum) is held on the cloth and the brine surface is thereby cleaned. Wash cloth, cover, and weight and replace them. If scum development is rapid, the cleaning operation should be carried out at about two-day intervals.

Storage of Preserved Material

After a fermentation period of about 2 weeks it is desirable to repack the fermented material into smaller containers for storage purposes. Pack clean glass jars tightly with the material and fill to within one-fourth to one-half inch of the top with brine from the original container. If there is not enough of this brine, make more brine by adding 1 ounce of salt and 2 ounces of vinegar to each quart of water. Partially seal the jars and heat in

boiling water bath, allowing 25 minutes for pints and 30 minutes for quarts. After removing from the bath, seal jars tightly. This process is not intended to take the place of cooking, but it does help prevent undesirable changes in the material that may occur when it is left in the larger container, exposed to the air, for long periods of time.

Uses of the Preserved Material

Vegetables preserved by this method may be served alone or according to recipes for sauerkraut.

DRY SALTING

Using a Large Amount of Salt

Some vegetables are best preserved with a considerable amount (20 percent by weight) of dry salt. Little or no acid is produced during fermentation at this salt concentration. This method is very satisfactory for commercial scale salt preservation. For commercial operations, larger containers and cooperage tools are required.

Vegetables

Corn	Lima beans (shelled)
Peas (shelled)	Snap beans
Okra	

Preparation of Vegetables

Select fresh, tender, carefully graded material.

Husk corn, remove silk, and boil 10 minutes to set the milk; then cut from the cob.

Use only young, tender okra.

Shell lima beans and peas.

Select a canning variety of snap beans, wash thoroughly, snip off ends, and cut into short lengths.

For best results, peas, lima beans, and snap beans should be blanched (scalded) 5 minutes in a boiling water bath or steamer; cool promptly.

Salting Procedure

Clean containers thoroughly. Mix salt with vegetable at a ratio of 1 to 5 by weight (20 pounds of salt for each 100 pounds of vegetables).

Salt should be mixed with the vegetables mechanically before packing in containers or they can be packed in alternate layers with salt by hand.

Pack into the container firmly but without crushing the vegetable. Head barrels and kegs and add strong brine (2-1/4 lbs. of salt dissolved in 1 gallon of water) to completely fill the containers.

For home-scale salting, using containers other than barrels or kegs, cover the salt-vegetable mixture, after packing, with several layers of clean white cheesecloth and tuck down the sides. Place a suitable cover on top that fits loosely inside the container and weight it well. Add strong brine (prepared as described in previous paragraph) until it comes over the cover. For storage of the preserved material, see directions on page 11.

For commercial use, refrigerated storage (at 35° F.) is recommended. Storage at this temperature inhibits fermentation which will eventually take place at ordinary temperature irrespective of the salt content.

Removing Salt

Vegetables preserved in this manner requires removal of salt before they are cooked. This can be done by covering with fresh water at the rate of one gallon to each pound of salted material and allow to soak overnight (at least 8 to 12 hours).

For vegetable soup mixtures, the salted material is added directly to the soup stock. Here the salt content of the vegetables is used to season the soup. For 1 gallon of soup, about one-half pound of salted vegetables can be used directly. Using salted vegetables in this way avoids the losses in food value accompanying desalting or soaking overnight.

BRINING

Using a Weak Brine Plus Vinegar

Some vegetables can be preserved in a weak brine (5 percent) in combination with vinegar. This results in a final product having a decidedly acid taste but rather low in salt content. It will be noted that snap beans can be preserved by three of the methods given. Salting with a large amount of salt is better adapted to large-scale preservation. Of the remaining two methods, that using a small amount of salt permits the packing of a larger amount of beans into the container. The weak-brine treatment is easiest to carry out and produces a satisfactory product.

Vegetables

Carrots	Kale
Cauliflower	Turnip greens
Snap beans	Mustard greens
Green tomatoes	Beet tops
Beets	

Preparation of Vegetables

Select fresh, tender, carefully graded material.

In general, prepare the vegetables as for table use by trimming and cleaning.

Wash greens several times to remove all traces of grit.

The snap beans (a canning variety) should be washed thoroughly and may be used whole or cut into pieces. They should be blanched (scalded) 5 minutes in a boiling water bath or a steamer and cooled promptly. Blanching in steam is the preferred method.

Wash carrots, beets, and tomatoes, but do not slice. Cut cauliflower into pieces.

Brining Procedure

1. Select sound containers such as large glass jars, crocks, kegs, or barrels and clean thoroughly. If possible, use wooden containers that are paraffined inside. Avoid using wooden containers made of yellow or pitch pine.
2. Pack the vegetable material firmly into the container until nearly full. On top of the packed vegetables place several layers of clean, white cheesecloth and tuck down the sides. On the cloth place a cover that fits loosely inside the container. A plate, crock top, or circular wooden top will do. Weight the cover down well, using paraffined bricks or clean stones, so that the vegetable material will be pressed down firmly.
3. Prepare the brine for adding to the packed vegetables as follows: Dissolve one-half pound (about 3/4 cup) of salt in 1 gallon of water to which has been added one-half pint (8 oz.) of household vinegar (4 to 5 percent, strength acetic acid). The amount of brine necessary to prepare will be equal to about one-half of the volume of vegetable material packed. For example, if a 10-gallon crock of material has been packed, about 5 gallons of brine will be required.
4. Pour the brine over the vegetables until it comes up over the weighted cover. In this treatment, no further salt is required. Store containers in a cool place.

Removal of Scum

A white scum will appear on the brine surface in a few days. Keep this scum removed. If allowed to grow unrestricted the material may spoil.

Scum and insects may be easily removed by the following procedure: Remove the weight and cover, being careful to avoid mixing the scum with the brine. Lift the cloth carefully so that the surface scum is held on the cloth and the brine surface is thereby cleaned. Wash cover, cloth, and weight and replace them. If scum development is rapid, the cleaning operation should be carried out at about two-day intervals.

Storage of Preserved Material

After a fermentation period of about two weeks, it is desirable, for prolonged storage purposes, to repack the fermented material into smaller containers. Pack clean glass jars tightly with the fermented vegetables and fill to within one-fourth to one-half inch of the top with brine from the original container. If necessary make new brine as described in 3. Place the partially sealed jars in a boiling water bath, allowing 25 minutes for pints and 30 minutes for quarts. After removing from the water bath, complete the sealing. This process is not intended to take the place of cooking, but it does help prevent undesirable changes in the material and losses in nutritive value when the material is left in the larger containers and exposed to the air for long periods of time.

Preparation for Cooking

Material preserved by the weak brine method does not ordinarily require desalting prior to cooking for table use. Rinsing well in water, then covering with fresh water and cooking should reduce the salt content enough for the average taste. However, the vegetables as removed from the brine will have a definitely acid taste. A portion of the acid will be boiled off during cooking; also, some will go into the cooking water. Even so, the final cooked product may be noticeably acid. Many people relish this acid flavor in certain cooked vegetables. If it is not desired in the cooked products, it will be necessary to soak the material (using one or two changes of water) for a short time prior to cooking. This procedure reduces the food value of the material and should be avoided, if possible, or reduced to a minimum.

Uses of the Preserved Material

As previously indicated, the preserved vegetables should be first rinsed well with water. They can then be served in various ways to suit the individual taste, such as in mixed vegetable dishes, creamed style, or in soups.

BRINING

Using a Strong Brine Solution

Some vegetables are best preserved by covering with a strong brine. Peas or lima beans may be brined either shelled or unshelled. In general, they would be brined in the unshelled condition only at times of a large surplus of produce and shortage of labor.

Vegetables

Green peas (in the pod)
Lima beans (in the pod)
Onions (silver skin type)
Whole cauliflower

Pepper hulls (green or red)
Corn (cut from cob)
Okra

Preparation of Vegetables

Select fresh, tender, carefully graded material.

Do not use peas or lima beans that are too old.

Remove outer skin of the onions (dry).

Trim cauliflower free of stalk and outer leaves.

Cut peppers in half, remove core and seeds.

Use fresh, tender okra.

Brining Procedure

1. Select sound containers such as jars, crocks, kegs, or barrels and clean thoroughly. If possible use wooden containers that are paraffined inside. Be sure that they are not made of yellow or pitch pine.
2. Pack the vegetables firmly into the container until nearly full. Keep a record of the weight of the material packed. Place on top of the vegetables several layers of clean, white cheesecloth. Place on the cloth a cover that fits loosely inside the container. Weight the cover down well, using paraffined bricks or clean stones, so that the vegetable material will be pressed down firmly.
3. Prepare a strong brine as follows: Dissolve $1\frac{1}{2}$ pounds of salt ($2\frac{1}{2}$ cups) in 1 gallon of water to which has been added 8 ounces of household vinegar. The amount of brine necessary to prepare will be equal to about one-half the volume of material packed. For example, if a 10-gallon crock of vegetables has been packed, about 5 gallons of brine will be required.
4. Pour the brine over the vegetables until it comes up over the weighted cover about 2 or 3 inches. Be sure that enough weight has been put on the cover to keep the vegetables under the brine.
5. In order to maintain the original brine strength, salt must be added on the cover, otherwise the brine will become diluted.
6. For every 10 pounds of material packed and brined weigh out 2 pounds (about 3 cups) of salt. Place the correct amount of salt carefully on the cover of the container. Avoid letting the salt go down the sides since this will result in a strong layer of brine on the bottom.
7. Store containers in a cool place (70 to 75° F.) and keep the brine level above the cover by adding brine from time to time (prepared as described in 3).

Storage of Preserved Material

Keep the brine surface free from insects and any surface growth that may form. After the bubbling has stopped (this may take several weeks) it is desirable to repack into smaller containers for prolonged storage. Pack containers tightly with the preserved material, (first removing the lima beans and peas from their pods) and then add brine from the original container up to the top of the jar. Seal tightly. Rubber or rubberized types of seals are not necessary. Caps lined with cardboard and having an oiled surface will do. If there is not enough of the original brine to complete the repacking, then prepare new brine as described in 3.

Removing Salt

Vegetable material preserved in this manner requires removal of salt prior to cooking and serving. This can be done by covering with fresh water at the rate of 1 gallon for each pound of salted material and allowing to soak overnight (at least 8 to 12 hours). For one-half pound of material, use one-half gallon of water (2 quarts).

Uses of Desalted Material

The vegetables, after removing the salt, may be served in various ways such as for mixed vegetable dishes, baked lima beans, creamed style, buttered, and for soups.

Uses of Preserved Material Without Removing the Salt

If vegetable soups are served frequently and in considerable amounts, it is possible to add the rinsed and drained salted vegetables directly to the soup stock. Here the salt content of the preserved material would go to seasoning the soup. Add one-fourth pound of salted material for two quarts of soup. For 1 gallon of soup, about one-half pound of salted vegetables can be used.

Using salted vegetables in this way avoids the losses in food value accompanying desalting of soaking.

Table 1.--Approximate weights of vegetables that can be packed into 1-quart, 1-gallon, and 10-gallon containers for brining or dry salting purposes.

Vegetable	Condition	Container size		
		1-qt. Pounds	1-gal. Pounds	10-gal. Pounds
Green peas *	Shelled, blanched	2-1/2	10	100
Lima beans *	Shelled, Blanched	2-1/2	10	100
Snap beans *	Blanched	1-1/2	6	60
Snap beans *	Not blanched	1	4	40
Carrots	Whole	1-1/2	6	60
Cabbage *	Shredded	2	8	80
Lettuce *	Shredded	2	8	80
Cauliflower	Cut pieces	1	4	40
Corn *	Cut from cob	2-1/2	10	100
Greens	Blanched	1 to 1-1/4	4-5	40-50
Greens	Not blanched	1/2	2	20

*Dry salted vegetables; figures represent the amount of salt-vegetable mixture packed per container.

Table 2.--DRY SALTING: Approximate quantities of salt to add to 1-pound and 10-pound amounts of fresh material receiving various dry salting treatments.

Treatment No.	Percent of salt by weight	Amount of salt* required for 1 pound of fresh Material	Amount of salt* required for 10 pounds of fresh material
1	2½	2 teaspoons	4 ounces or a scant ½ cup
2	5	4 teaspoons	8 ounces or slightly over ¾ cup
3	10	2 tablespoons + 2 teaspoons	1 pound or 1½ cups
4	15	4 tablespoons or ¼ cup	1½ pounds or 2½ cups
5	20	5 tablespoons + 1 teaspoon	2 pounds or 3 cups

*Quantities figured on the basis of level teaspoons, tablespoons, and cups.

Salt equivalents: 1 tablespoon + 2 teaspoons = 1 ounce;
 16 tablespoons + 1 teaspoon = 1 cup;
 ½ cup = 5 ounces; 1 cup = 10 ounces;
 1½ cups = 1 pound.

Table 3.--BRINING: Quantity of salt required (in ounces per quart, ounces per gallon, pounds per gallon, and cups per gallon of water) to prepare brines of different strengths.

Treatment: No.	Approximate: percent salt solution	Degrees Sal- ometer*	Approximate amount of salt to add in terms of--			
			Ounces per: quart of water	Ounces per: gallon of water	Pounds per: gallon of water	Cups per: gallon of water
1	1	5	$\frac{1}{2}$	1-3/4	1/10	1/6
2	2 $\frac{1}{2}$	10	1	3 $\frac{1}{2}$	$\frac{1}{4}$	1/3
3	5	20	1-3/4	7 $\frac{1}{2}$	$\frac{1}{2}$	3/4
4	10	40	4	16	1	1 $\frac{1}{2}$
5	15	60	6 $\frac{1}{4}$	25	1 $\frac{1}{2}$	2 $\frac{1}{2}$
6	20	80	9	36	2 $\frac{1}{4}$	3 $\frac{1}{2}$
7	26	100	12	48	3	4-3/4

*Indicating the percent saturation with respect to salt.

Note: In brining vegetables, the amount of brine necessary to prepare will be equal to about one-half the volume of material packed. For example, if a 10-gallon crock of vegetables has been packed, about 5 gallons of brine will be required.

REFERENCES

The directions for salting and brining vegetable material contained herein are based on the joint U. S. Department of Agriculture--North Carolina Agricultural Experiment Station investigational work on food preservation and the following additional sources of information on the subject. Acknowledgment is hereby made for the valuable suggestions used.

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